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(54) **Cooling garment**

(57) Cooling garment for cooling a person wearing the garment, the garment having an inner and an outer side, comprising a network of tubes connected to the inner side, means for circulating a fluid from a heat absorption container through the tubes and back to the container, the means, the container and the tubes being connected into at least one fluid circuit, wherein the container

and the means for circulating the fluid are stored in a housing having detachable means for connecting the housing to the garment or to the person at a position around a waist portion of the garment resp. around the waist of the person.

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Description

[0001] The invention relates to a cooling garment for cooling a person wearing the garment, the garment having an inner and an outer side, comprising a network of tubes connected to the inner side, means for circulating a fluid from a heat absorption container through the tubes and back to the container, the circulating means, the container and the tubes being connected into at least one fluid circuit.

[0002] Such garment is known from Patent Application FR 2,836,339.

[0003] This document is silent about the position of the container with respect to the person. To create optimal mobility for the person wearing the garment, preferably he carries all the equipment needed without any permanent connection to external sources or machinery. Carrying such equipment, however, may hamper the person in his activities, such as doing sport, playing games, exercising or running and the like.

[0004] Aim of the invention is to provide a cooling garment wherein the user experiences minimal disadvantage or hampering from carrying the cooling equipment.

[0005] This is achieved according to the invention in that the container and the means for circulating the fluid are stored in a housing having detachable means for connecting the housing to the garment or to the person at a position around a waist portion of the garment resp. around the waist of the person.

[0006] Since a person's waist is the part of his body that is most stable during running, the housing undergoes the least movement with respect to the body's center of gravity. Also the waist bends much less and less frequent than the arm or legs. As a consequence the smallest forces possible are exerted on the body by the housing. It further prevents pinching off of the tubes when the housing is mounted on more mobile positions of the body. The position around the waist is also ideal for cooling of both the upper and the lower part of the body.

[0007] Examples of garments useful in the invention are a vest, a jacket, trousers or a combination of these. The garment can be made of natural or artificial fiber fabric or sheet. A network of tubes is connected to the inner side of the garment i.e. the side facing the person wearing it. The garment may be a single layer or multilayer garment, e.g. comprise an outer layer and a lining. The tubes will be connected to the inner side, which may be the inner side of the single layer or to the inner layer of a multilayer garment. In multilayer garments the tubes usually are positioned between the inner layer and an adjacent layer. The tubes are distributed over the inner side in a pattern covering the parts of the person's body that are to be cooled. The tubes have an inlet end and an outlet end. It is possible to have more tubes, each having an inlet end and an outlet and each forming a part of the total pattern. The inlet ends and the outlet ends are connected to means for circulating a fluid and a heat absorption container, the tubes, the circulating means

and the container volume forming a closed fluid circuit, All tubes can be connected to the same means for circulating the fluid and the same container but is also possible to have each tube connected to its own container and its own means for circulating the fluid, thus forming independent fluid circuits. Inlet end and outlet end of a circuit can be connected to the container at distant positions to avoid a shortcut between the ends. This can be achieved e.g. by connecting the inlet end at or near the top side, i.e. the side that in use will have a higher position, and the outlet near the side opposite to the top side. This also has the advantage that the fluid flowing to the body comes from the coldest part of the container. Preferably the inlet end and the outlet end are connected to a removable lid of the container. This allow easy exchange of warmed-up with fresh cold containers. In this case a pipe connected to the outlet end connection with the lid may extend on the inside of the lid into the container, whereas the inlet end connection with the lid just opens into the container. In this way shortcut between inflow and outflow of the container is avoided and again the outlet flow is taken from the coldest part of the container contents. It is also possible to have a separating sheet extending from the inside of the lid into the container. This also prevents shortcut of inflow and outflow of the container.

[0008] The circulation means and the container are stored in a housing. If there are more independent fluid circuits, each set of circulating means and associated container can be stored in a separate housing or, alternatively more than one set may be stored in the same housing.

[0009] The housing can be fixed to the garment but preferably housing and garment are separate, though optionally connectable, items. Thus, preferably the housing or housings can be releasably attached to the garment or by separate means to the person's body all around the waist, e.g. by connecting it to a belt around the person's waist, apart from or forming part of the garment. In another embodiment the garment has Velcron pieces or strips, snap fasteners or other two component fasteners mounted around the waist portion and cooperating with complementary elements of the Velcron pieces or fasteners on the housing. Both embodiments allow choosing the position the housing at the front, at the back or at the side of, so all around, the body.

[0010] The housing can be constructed from any, preferably water resistant, material like textile, leather, flexible or hard plastics.

[0011] The means for circulating the fluid can be a pump or any other device that can maintain a fluid flow, like a pump.

[0012] Preferably the means are electrical means that can be fed by a battery. This battery preferably is also contained in the housing. It is electrically connected to the circulation means preferably with common state of the art connectors for easy exchange of the battery.

[0013] The heat absorption container can be of metal or plastic and preferably is thermally insulated. In the

container heat is absorbed from the inflowing fluid thus lowering the temperature of the fluid before it flows out of the container back into the tubes. The fluid in the container thus has to be colder than the incoming fluid returning from the garment. To this end the container can be filled initially with ice water, preferably containing ice cubes, anti-freezing agents or other liquids cooled below 0 C. The heat absorption will take place by heat exchange between the incoming liquid and the, initially much colder, container contents. The container contents then gradually will rise in temperature until the temperature of the container contents becomes close or equal to the temperature of the incoming fluid the container contents will be replaced by fresh, cold fluid.

[0014] It is advantageous to have in the container a device or material that can cool the liquid in the container. Examples of these are Peltier elements, phase change materials or miniature refrigerator cooling devices. The battery already present in the system may supply the electrical power required for operating such devices. This avoids the need to refresh the fluid with cold fluid frequently and at least considerably extends the time before exchange is needed.

[0015] Preferably the housing is divided into a first and a second compartment, the first compartment containing the container and the second compartment containing the means for circulating the fluid and the battery. This construction has the advantage that the electrical part of the equipment is separated as much as possible from the wet, fluid containing part, minimizing the risk of short circuit. Preferably at least the compartment of the housing containing the container is thermally insulated. It has opening for the tubes to enter and leave it. The tubes, the circulation means and the container may be mutually connected by common, state-of-the-art fluid connectors. Preferably the compartment containing the electrical equipment has one or more openings to the environment allowing cooling of the circulation means.

[0016] The circuit preferably is further provided with a switch to operate the circulation means and a device for controlling the flow in the circuit. The latter allows controlling the flow rate of cooling liquid and thus the cooling capacity of the garment. The device for controlling the flow rate can be of mechanical nature, e.g. a clamp restricting the diameter of the tube locally but preferably is of electrical nature and controls the throughput rate of the circulation means.

[0017] When the garment is in use, over time the temperature of the fluid forced through the circuit will increase from the initial temperature of the fluid in the container to the temperature of the environment or even approach that of the person wearing the garment. The means to control the flow described above can only partially compensate this temperature rise over time.

[0018] For a person to be cooled in particular the initial lowest temperature may be undesired or even unwanted as causing too strong local cooling, which may cause muscle injury.

[0019] To keep the temperature as long as possible on a desired, nearly constant temperature the fluid circuit comprises means for mixing a variable part of the fluid flowing back to the container with the fluid flowing from the container.

[0020] In this way the fluid returning to the container and heated by heat exchange with the person wearing the garment can be mixed with a variable amount of cold liquid from the container to bring the temperature of the fluid entering the tubes to a desired level. When the temperature of the fluid in the container increases gradually by the mixing with a part of the returning fluid, the mixing ratio can be adapted to add more and more of the cool liquid to obtain fluid entering the circuit of still about a constant temperature. This process can continue until the liquid in the container has obtained the temperature of the returning fluid. At that time fresh cooling liquid must be supplied to the container or the container has to be exchanged by a fresh, cold one. To avoid or to postpone the need for such exchange, alternatively a cooling device is present and operated to cool the fluid in the container or material as mentioned above.

Claims

1. Cooling garment for cooling a person wearing the garment, the garment having an inner and an outer side, comprising a network of tubes connected to the inner side, means for circulating a fluid from a heat absorption container through the tubes and back to the container, the means, the container and the tubes being connected into at least one fluid circuit, **characterized in that** the container and the means for circulating the fluid are stored in a housing having detachable means for connecting the housing to the garment or to the person at a position around a waist portion of the garment resp. around the waist of the person.
2. Garment according to claim 1, wherein the means for circulating the fluid are electrical means, fed by a battery that is also contained in the housing.
3. Garment, according to claim 1 or 2, wherein the housing is divided into a first and a second compartment, the first compartment containing the container and the second compartment containing the means for circulating the fluid and the battery.
4. Garment, according to claim 1 to 3, wherein the fluid circuit comprises means for mixing a variable part of the fluid flowing back to the container with the fluid flowing from the container.
5. Garment according to any of claims 1-4, wherein a cooling device or material is present to cool the fluid in the container.



European Patent
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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 24 April 2008	Examiner Debard, Michel
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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